

REMARKS

The specification and claims 1 and 4-6 have been amended, claims 7-12 have been cancelled, and new claims 13-16 have been added. Claims 1-6 and 13-16 are pending, with claims 1 and 4-6 being independent.

Attached hereto is an Appendix entitled "Version with Markings to Show Changes Made" which is a marked-up version of the portions of the application which have been amended by the present amendment, with brackets indicating deleted matter and underlining indicating added matter.

New claims 13-16 respectively depending from independent claims 1 and 4-6 have been added to recite a further feature of the present invention.

Claim 1 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 6,161,194 which issued from parent application Serial No. 09/162,444 of the present application for the reasons set forth on pages 2-3 of the Office Action of December 17, 2001.

Claim 3 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 8 of U.S. Patent No. 6,161,194 for the reasons set forth on page 3 of the Office Action of December 17, 2001.

Claims 4 and 6 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 11 of U.S. Patent No. 6,161,194 for

the reasons set forth on pages 3-4 of the Office Action of December 17, 2001.

Claim 5 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 6,161,194 for the reasons set forth on page 4 of the Office Action of December 17, 2001.

Claims 7-12 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 6,161,194 for the reasons set forth on page 5 of the Office Action of December 17, 2001.

Claim 1 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 5,941,993 which issued from grandparent application Serial No. 08/895,886 of the present application for the reasons set forth on pages 5-6 of the Office Action of December 17, 2001.

Claim 3 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 5 of U.S. Patent No. 5,941,993 for the reasons set forth on pages 6-7 of the Office Action of December 17, 2001.

Claims 4 and 6 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 5 of U.S. Patent No. 5,941,993 for the

reasons set forth on pages 7-8 of the Office Action of December 17, 2001.

Claim 5 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 5,941,993 for the reasons set forth on pages 8-9 of the Office Action of December 17, 2001.

Claims 7, 9, and 11 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of U.S. Patent No. 5,941,993 for the reasons set forth on pages 9-10 of the Office Action of December 17, 2001.

Claims 8, 10, and 12 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 5 of U.S. Patent No. 5,941,993 for the reasons set forth on pages 10-11 of the Office Action of December 17, 2001.

Claim 7 was rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 13 of U.S. Patent No. 6,000,039 which issued from related application Serial No. 08/895,986 for the reasons set forth on page 11 of the Office Action of December 17, 2001. Related application Serial No. 08/895,986, like grandparent application Serial No. 08/895,886 of the present application referred to above, is a continuation of great-grandparent application Serial No. 08/534,841 of the present application.

It is noted that claim 2 was not rejected under the judicially created doctrine of obviousness-type double patenting.

The obviousness-type double patenting rejections of claims 7-12 have been rendered moot by the cancellation of claims 7-12.

As recognized by the Examiner on page 2 of the Office Action of December 17, 2001, the obviousness-type double patenting rejections of claims 1 and 3-6 can be overcome by filing a terminal disclaimer. Although the propriety of these rejections is not conceded, solely in an effort to eliminate these issues and advance the prosecution of the application, submitted herewith is a terminal disclaimer to overcome these rejections.

In view of the submission of the terminal disclaimer, it is respectfully requested that the obviousness-type double patenting rejections of claims 1 and 3-6 be withdrawn.

Claims 1-12 were rejected under 35 USC 102(e) as being anticipated by Stallmo (U.S. Patent No. 5,390,187) (Stallmo '187). The rejection of claims 7-12 has been rendered moot by the cancellation of claims 7-12. The rejection of claims 1-6 is respectfully traversed insofar as it may be deemed to be applicable to claims 1-6 in their present form and to new claims 13-16.

Independent claims 1 and 4-6 have been amended to recite, inter alia, that the controller is operable in a first mode wherein a frequency of the processing of reconstructing data

within a unit time in the plurality of disc units is higher than a frequency of the processing of data read/write requests within the unit time in the plurality of disc units, and a second mode wherein a frequency of the processing of data read/write requests within a unit time in the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units.

New claims 13-16 respectively depending from independent claims 1 and 4-6 recite that both the processing of reconstructing data and the processing of data read/write requests are performed in both the first mode and the second mode.

In explaining the rejection of claims 1 and 4-6, the Examiner states as follows in pertinent part:

As in claim 1, Stallmo discloses a data storage system connectable to a host unit (CPU) which issues data read/write requests to the data storage system, wherein the data storage system comprises a plurality of disc units and a controller connected to the disc unit, wherein a fault can occur in any of the disc units, wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups, wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and performs processing of data read/write requests from the host unit, and wherein the controller is operable in a first mode wherein the processing of reconstructing

data has priority over the processing of data read/write requests, and a second mode wherein the processing of data read/write requests has priority over the processing of reconstructing data (i.e., during a reconstruction process, read/write operations are not active (reconstruction process has priority) unless the reconstruction process is interrupted to permit read/write operations (read/write operations have priority) (Figures 1 and 3-5, column 1: line 15 - column 4: line 62, column 8: line 4 - column 10: line 43).

. . . .

As in claims 4, 5, 6, 7, 8, 9, 10, 11 and 12, Stallmo discloses a data storage system connectable to a host unit (CPU) which issues data read/write requests to the data storage system, wherein the data storage system comprises a plurality of disc units and a controller connected to the disc unit, wherein a fault can occur in any of the disc units, wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups, wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and performs processing of data read/write requests from the host unit, and wherein the controller is operable in a first mode wherein the processing of reconstructing data has priority over the processing of data read/write requests, and a second mode wherein the processing of data read/write requests has priority over the processing of reconstructing data (i.e., during a reconstruction process, read/write operations are not active (reconstruction process has priority) unless the reconstruction process is interrupted to permit read/write operations (read/write operations have priority) (Figures 1 and 3-5, column 1:

line 15 - column 4: line 62, column 8:
line 4 - column 10: line 43).

The Examiner apparently considers Stallmo '187 to disclose a first mode in processing of reconstructing data is performed and processing of data/read write requests is not performed, and a second mode in which processing of reconstructing data is interrupted so that processing of data/read write requests can be performed. These two modes are described, for example, in column 8, lines 4-14, of Stallmo '187 which reads as follows:

Concurrent I/O Tasks

During the general reconstruction process, processing by the CPU 1 can continue, but with some possible performance degradation for the computer system. As described below, the general reconstruction process may be interrupted to permit a Read or Write operation requested by the CPU 1 (Steps 33, 35). Such interruptions are preferably implemented by means of concurrent tasks in well-known fashion. However, the invention encompasses any means of concurrent and/or interrupt-driven I/O operation.

However, it is submitted that neither this passage nor any other passage of Stallmo '187 discloses the feature now recited in claims 1 and 4-6 wherein the controller is operable in a first mode wherein a frequency of the processing of reconstructing data within a unit time in the plurality of disc units is higher than a frequency of the processing of data read/write requests within the unit time in the plurality of disc units, and a second mode wherein a frequency of the processing of data read/write requests within a unit time in

the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units.

Furthermore, since only the processing of reconstructing data is performed in the first mode of Stallmo '187 and only the processing of data read/write requests is performed in the second mode of Stallmo '187, it is submitted that Stallmo '187 does not disclose the feature of new claims 13-16 respectively depending from independent claims 1 and 4-6 wherein both the processing of reconstructing data and the processing of data read/write requests are performed in both the first mode and the second mode.

Claim 2 recites a data storage system according to claim 1, wherein the controller determines whether to operate in the first mode or the second mode based on an urgency of data reconstruction.

In explaining the rejection of claim 2, the Examiner states as follows:

As in claim 2, Stallmo discloses that the controller determines whether to operate in the first mode or the second mode based on an urgency of data reconstruction (Abstract, column 8: lines 4-51).

However, it is submitted that nothing whatsoever in column 8, lines 4-51, of Stallmo '187 relates to an urgency of data reconstruction. Nor has the Examiner explained how this passage of Stallmo '187 may be considered to disclose the feature of claim 2 wherein the controller determines whether

to operate in the first mode or the second mode based on an urgency of data reconstruction.

Accordingly, it is submitted that Stallmo '187 does not disclose the feature of claim 2 wherein the controller determines whether to operate in the first mode or the second mode based on an urgency of data reconstruction.

Claim 3 recites a data storage system according to claim 1, wherein the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time.

In explaining the rejection of claim 3, the Examiner states as follows:

As in claim 3, Stallmo discloses that the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time (i.e., the data in the requested data block is reconstructed "on the fly" (fixed time) so that the pending read operation can access the requested data block) (Abstract, column 8: lines 4-16).

Column 8, lines 35-45, of Stallmo '187 reads as follows:

If the Read operation requested by the CPU 1 is for a data block on the replacement storage unit S1' (Step 42), the procedure is different. The controller 3 instead reconstructs the stripe containing the requested data block "on-the-fly". The controller 3 reads all of the other data blocks and the corresponding parity block in the stripe (Step 47). The blocks are then XOR'd to generate a corrected data block, which is then transferred to the CPU 1 via the controller 3 (Step 48). Thereafter, the controller 3 unlocks the reconstruction stripe (Step 44), and the Read task terminates (Step 45).

It is submitted that it is readily apparent from this passage of Stallmo '187 that reconstructing data "on the fly" does not mean completing data reconstruction within a fixed time as recited in claim 3 as alleged by the Examiner, but simply means that data is reconstructed as it is being read. It is submitted that nothing whatsoever in Stallmo '187 discloses determining whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time as recited in claim 3.

Accordingly, it is submitted that Stallmo '187 does not disclose the feature of claim 3 wherein the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time.

Independent claim 4 recites, inter alia, that the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time which is determined before the processing of reconstructing data begins.

In explaining the rejection of claim 4, the Examiner states as follows in pertinent part:

Stallmo also discloses that the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time (i.e., the data in the requested data block is reconstructed "on the fly" (fixed time) after a request (i.e., a condition) is made by the read operation so that the pending read operation can access the requested data block) (Abstract, column 8: lines 4-16).

However, it is submitted that Stallmo '187 does not disclose the feature of claim 4 wherein the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time which is determined before the processing of reconstructing data begins for at least substantially the same reasons discussed above that Stallmo '187 does not disclose the similar feature of claim 3.

Furthermore, it is submitted that nothing whatsoever in Stallmo '187 discloses determining a fixed time within which data reconstruction is to be completed before the processing of reconstructing data begins. Nor did the Examiner address this feature of claim 4 in explaining the rejection.

Accordingly, it is submitted that Stallmo '187 does not disclose the feature of claim 4 wherein the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time which is determined before the processing of reconstructing data begins.

Independent claim 5 recites, inter alia, that the controller determines whether to operate in the first mode or the second mode based on a condition determined before the processing of reconstructing data begins.

It is submitted that Stallmo '187 does not disclose the feature of claim 5 wherein the controller determines whether to operate in the first mode or the second mode based on a condition determined before the processing of reconstructing

data begins for at least substantially the same reasons discussed above that Stallmo '187 does not disclose the similar feature of claim 4. Nor did the Examiner specifically address this feature of claim 5 in explaining the rejection.

Independent claim 6 recites, inter alia, that the controller determines whether to operate in the first mode or the second mode based on a time for reconstructing data which is determined before the processing of reconstructing data begins.

It is submitted that Stallmo '187 does not disclose the feature of claim 6 wherein the controller determines whether to operate in the first mode or the second mode based on a time for reconstructing data which is determined before the processing of reconstructing data begins for at least substantially the same reasons discussed above that Stallmo '187 does not disclose the similar feature of claim 4. Nor did the Examiner specifically address this feature of claim 6 in explaining the rejection.

Since Stallmo '187 does not disclose the features of claims 1-6 and 13-16 discussed above, it is submitted that claims 1-6 and 13-16 patentably distinguish over Stallmo '187 in the sense of 35 USC 102(e), and it is respectfully requested that the rejection of claims 1-6 under 35 USC 102(e) as being anticipated by Stallmo '187 be withdrawn.

As recognized by the Examiner, the other references cited but not relied upon neither disclose nor suggest the present

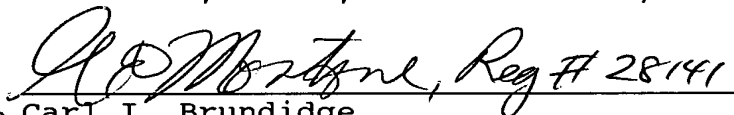
invention, and thus no further discussion of these other references is deemed necessary at this time.

It is submitted that all of the Examiner's rejections have been overcome, and that the application is now in condition for allowance. Reconsideration of the application and an action of a favorable nature are respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (500.31108CC5).

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

for  Reg # 28141
Carl I. Brundidge
Registration No. 29,621

CIB/RSS
(703) 312-6600

Attachment

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Changes made to the application by the present amendment are indicated below, with brackets indicating deleted matter and underlining indicating added matter.

IN THE SPECIFICATION

The paragraph on page 1, lines 2-8, as amended by the preliminary amendment of November 15, 2000, has been deleted and replaced with the following replacement paragraph:

--This application is a continuation of application Serial No. 09/162,444 filed on September 29, 1998, now U.S. Patent No. 6,161,194, which is a continuation of application Serial No. 08/895,886 filed on July 17, 1997, now U.S. Patent No. 5,941,993, which is a continuation of application Serial No. 08/534,841 filed on September 27, 1995, now U.S. Patent No. 5,889,938, which is a continuation of application Serial No. 07/859,850, filed on March 30, 1992, now U.S. Patent No. 5,495,572. The contents of application Serial Nos. 09/162,444, 08/895,886, 08/534,841, and 07/859,850 are hereby incorporated herein by reference in their entirety.--

IN THE CLAIMS

Claims 7-12 have been cancelled.

New claims 13-16 have been added.

Claims 1 and 4-6 have been amended as follows:

--1. (Amended) A data storage system connectable to a host unit which issues data read/write requests to the data storage system, the data storage system comprising:

a plurality of disc units; and

a controller connected to the disc units;

wherein a fault can occur in any of the disc units;

wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups;

wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and performs processing of data read/write requests from the host unit; and

wherein the controller is operable in

a first mode wherein a frequency of the processing of reconstructing data [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of data read/write requests within the unit time in the plurality of disc units, and

a second mode wherein a frequency of the processing of data read/write requests [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units.--

--4. (Amended) A data storage system connectable to a host unit which issues data read/write requests to the data storage system, the data storage system comprising:

a plurality of disc units; and

a controller connected to the disc units;

wherein a fault can occur in any of the disc units;

wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups;

wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and performs processing of data read/write requests from the host unit;

wherein the controller is operable in

a first mode wherein a frequency of the processing of reconstructing data [has priority over] within a unit time in the plurality of disc units is higher than a frequency of

the processing of data read/write requests within the unit time in the plurality of disc units, and

a second mode wherein a frequency of the processing of data read/write requests [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units; and

wherein the controller determines whether to operate in the first mode or the second mode in order to complete data reconstruction within a fixed time which is determined before the processing of reconstructing data begins.

5. (Amended) A data storage system connectable to a host unit which issues data read/write requests to the data storage system, the data storage system comprising:

a plurality of disc units; and

a controller connected to the disc units;

wherein a fault can occur in any of the disc units;

wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups;

wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and

performs processing of data read/write requests from the host unit;

wherein the controller is operable in

a first mode wherein a frequency of the processing of reconstructing data [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of data read/write requests within the unit time in the plurality of disc units, and

a second mode wherein a frequency of the processing of data read/write requests [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units; and

wherein the controller determines whether to operate in the first mode or the second mode based on a condition determined before the processing of reconstructing data begins.

6. (Amended) A data storage system connectable to a host unit which issues data read/write requests to the data storage system, the data storage system comprising:

a plurality of disc units; and

a controller connected to the disc units;

wherein a fault can occur in any of the disc units;

wherein the disc units store data in a plurality of data groups and error correcting data corresponding to each of the data groups;

wherein the controller performs processing of reconstructing data stored in any of the disc units in which a fault has occurred based on all other data belonging to any of the data groups to which the data to be reconstructed belongs and error correcting data corresponding to any of the data groups to which the data to be reconstructed belongs, and performs processing of data read/write requests from the host unit;

wherein the controller is operable in

a first mode wherein a frequency of the processing of reconstructing data [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of data read/write requests within the unit time in the plurality of disc units, and

a second mode wherein a frequency of the processing of data read/write requests [has priority over] within a unit time in the plurality of disc units is higher than a frequency of the processing of reconstructing data within the unit time in the plurality of disc units; and

wherein the controller determines whether to operate in the first mode or the second mode based on a time for reconstructing data which is determined before the processing of reconstructing data begins.--